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Washington, D.C. 20231

Case Docket No. P7156-9012
Date March 16, 1999

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the patent application of:
Inventor(s): Kazuya KINOSHITA

For: NOISE LEVEL UPDATING SYSTEM

- ☒ Specification (7 pages)
☒ 5 sheets of drawings
☒ Declaration and Power of Attorney
☒ Return Receipt Postcard
☒ An Assignment of the invention to PIONEER ELECTRONIC CORP. with PTO-1595
☒ A certified copy of Japanese application(s) No.(s) 10-072904; dated March 20, 1998
☒ A filing fee, calculated as shown below:

10518 U.S. PTO
09/270273
03/16/99

	(Col. 1)	(Col. 2)
FOR:	No. Filed	No. Extra
BASIC FEE		
TOTAL CLAIMS	3 - 20 =	* 0
INDEP CLAIMS	1 - 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENTED		

Small Entity		or	Other Than A Small Entity	
RATE	FEE		RATE	FEE
	\$380	or		\$760
x 9 =		or	x 18 =	0
x 39 =		or	x 78 =	0
+130 =		or	+260 =	0
TOTAL		or	TOTAL	\$760

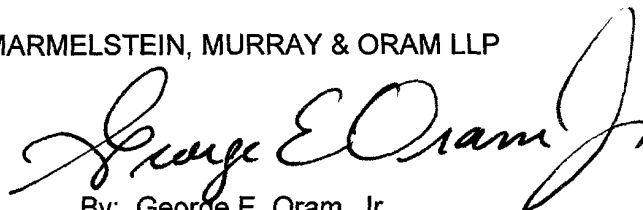
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Respectfully submitted,

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Enclosures: Check #19011/Specification and Claims/Declaration/Priority Document (1)
Drawings (5 sheets)/Assignment/PTO-1595 Form/Return Receipt Postcard

TITLE OF THE INVENTION

Noise Level Updating System

BACKGROUND OF THE INVENTION

5 The present invention relates to a noise level updating system for reducing a noise component included in an input signal.

Heretofore, a noise reduction system, wherein a signal component having a level lower than a predetermined level is cut as noises, is known.

10 The present applicant has disclosed a noise reduction system in the Japanese Patent Application Laid Open (Japanese Patent Application 9-310231). In the system, a noise level of a sound portion of an inputted music signal is detected by a noise analysis section, a signal lower than the noise level is cut.

15 The noise analysis section will be described with reference to Fig. 4. A high frequency component higher than 13KHz is extracted from an input signal S_i by a high pass filter 1 to produce a high pass signal S_h . The high pass signal S_h is converted to a rectified signal S_{hn} by a rectifier circuit 2, and a low frequency region (an envelop component of the rectified signal S_{hn}) is extracted by a low pass filter 3 to produce an
20 extracted signal S_{ln} which is inputted in a level analysis circuit 4.

On the other hand, the input signal S_i is also applied to a rectifier circuit 5, thereby producing a rectified signal S_{in} which is fed to a low pass filter 6 to produce an extracted signal S_l . The extracted signal is
25 fed to the level analysis circuit 4. The level analysis circuit 4 samples signals S_{ln} and S_l and holds a minimum value, and produces the minimum value as a noise level detecting signal S_a based on the extracted signals S_{in} and S_i .

Referring to Figs. 5a to 5c, Fig. 5a shows a waveform of an entire frequency region of the input music signal Si, and Fig. 5b shows signals Shn (solid line), Sln (dotted line).

Fig. 5c shows a waveform of the signal Sa. As shown in Fig. 5c, the level analysis circuit 4 produces a minimum value at every sampling timing as the signal Sa. Last of all, the minimum value signal Sa is held constant.

However, since the minimum value signal Sa is held constant, noises can not be reduced when the level of the noises heightens.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a noise reduction system which may remove noises even if the level of noise changes.

According to the present invention, there is provided a noise level updating system comprising, detector means for detecting a noise level of an input signal, a noise level holding section for holding a noise level detected by the detector means as a reference value, determining means for determining updating of the noise level held in the noise level holding section based on a plurality of subsequent noise levels and updating means for updating the held noise level in accordance with determination of the determining means.

The determining means determines the updating of the held noise level when the difference between the subsequent noise levels is smaller than a predetermined value and the difference between the held noise level and the subsequent noise levels is larger than a predetermined value.

In another aspect of the present invention, the determining means determines the updating of the held noise level when the difference

between an average value of the subsequent noise levels and the held noise level is larger than a predetermined value.

These and other objects and features of the present invention will become more apparent from the following detailed description with
5 reference to the accompanying drawing.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a block diagram showing a system of the present invention;

- 10 Fig. 2 is a flowchart showing the operation of the system;
Figs. 3a and 3b are time charts of the operation;
Fig. 4 is a block diagram showing a conventional system; and
Figs. 5a to 5c show waveforms of signals in the system of Fig. 4.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1, the high pass filter 1, rectifier circuit 2 and low pass filter 3 are the same as those of Fig. 4.

- The output signal S_{ln} of the low pass filter 3, which represents a noise level is applied to a first minimum value hold section 7 and a
20 second minimum value hold section 8.

The first minimum value hold section 7 samples a high frequency component of the music signal at every T-HOLD time (Fig. 3b) and holds a noise minimum reference value A (Figs. 3a, 3b).

- The noise minimum reference value A is fed to a comparator 10
25 and a gain calculator 11. The gain calculator 11 calculates the gain of the music signal and applies the gain to a noise reduction system (not shown).

The second minimum value hold section 8 also samples a high

frequency component of the music signal at every T-HOLD time (Fig. 3b) and holds a noise minimum reference value B as a real time reference value (Fig. 3b). A reset circuit 9 resets the output signal of the second minimum value hold circuit 8 at every T-HOLD time, and
5 calculates an average value of values at every three times. The average minimum value B is fed to the comparator 10.

The comparator compares the value B with the value A. When the difference ΔN between values A and B is larger than a predetermined value, the value A is updated to the value B.

10 The operation of the system will be described with reference to the flowchart of Fig. 2.

At a step S1, the minimum value A is held at the first hold section
7.

The value A is applied to the noise reduction system through the
15 gain calculator 11.

At a step S3, the second hold section 8 holds the minimum value B at the real time. It is determined whether the predetermined T-HOLD time for the sampling time for detecting the real time minimum hold value B has elapsed at a step S4. When the time elapses, the program
20 proceeds to a step S5. At the step S5, it is determined whether the difference between an n-th minimum value and a (n-1)th minimum value, and the difference between the (n-1)th minimum value and a (n-2)th value are smaller than a predetermined value. When it is the case, namely noise levels are substantially constant, an average value of the
25 minimum values of nth, (n-1)th and (n-2)th is calculated at a step S6.

At a step S7, the nth value is changed as the (n-1)th value, the (n-1)th value is changed as the (n-2)th value, and the nth value is cleared for holding a new value B at a step S3 as described later on.

At a step S8, it is determined whether the difference between the minimum value A and the average value is larger than a predetermined value. When the difference is larger than the predetermined value, the minimum value A is updated to the average value at a step S9.

- 5 At a step S10, when the end of the operation is instructed, the program ends. If the end is not instructed, the program returns to the step S3, where a new minimum value B is held as an nth value.

10 In accordance with the present invention, the minimum reference value A is always compared with the real time reference value B and the reference value A is updated with the reference value B. Therefore, noises can be exactly removed even if the noise level changes with time.

15 While the invention has been described in conjunction with preferred specific embodiment thereof, it will be understood that this description is intended to illustrate and not limit the scope of the invention, which is defined by the following claims.

What is claimed is

1. A noise level updating system comprising:
 - detector means for detecting a noise level of an input signal;
 - a noise level holding section for holding a noise level detected by
 - the detector means as a reference value;
 - determining means for determining updating of the noise level held
 - in the noise level holding section based on a plurality of subsequent
 - noise levels; and
 - updating means for updating the held noise level in accordance
 - with determination of the determining means.
2. The system according to claim 1 wherein the determining means determines the updating of the held noise level when the difference between the subsequent noise levels is smaller than a predetermined value and the difference between the held noise level and
- the subsequent noise levels is larger than a predetermined value.
3. The system according to claim 1 wherein the determining means determines the updating of the held noise level when the difference between an average value of the subsequent noise levels and the held noise level is larger than a predetermined value.

NOISE LEVEL UPDATING SYSTEM

Abstract of the Disclosure

5 A noise level of an input signal is detected, and a detected noise level is held in a noise level holding section. The held noise level is updated when a subsequent noise level largely changes.

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FIG. 1

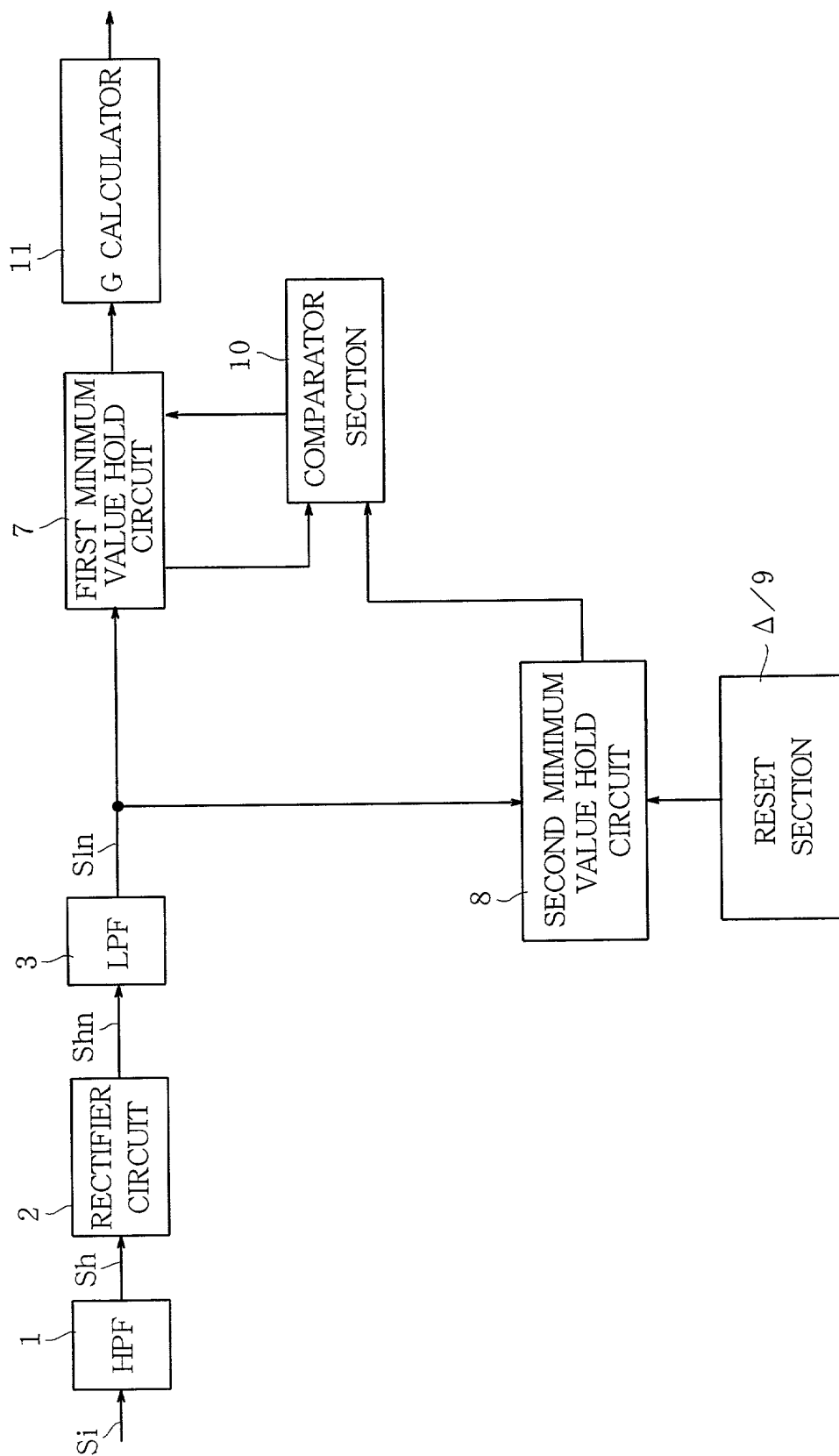


FIG.2

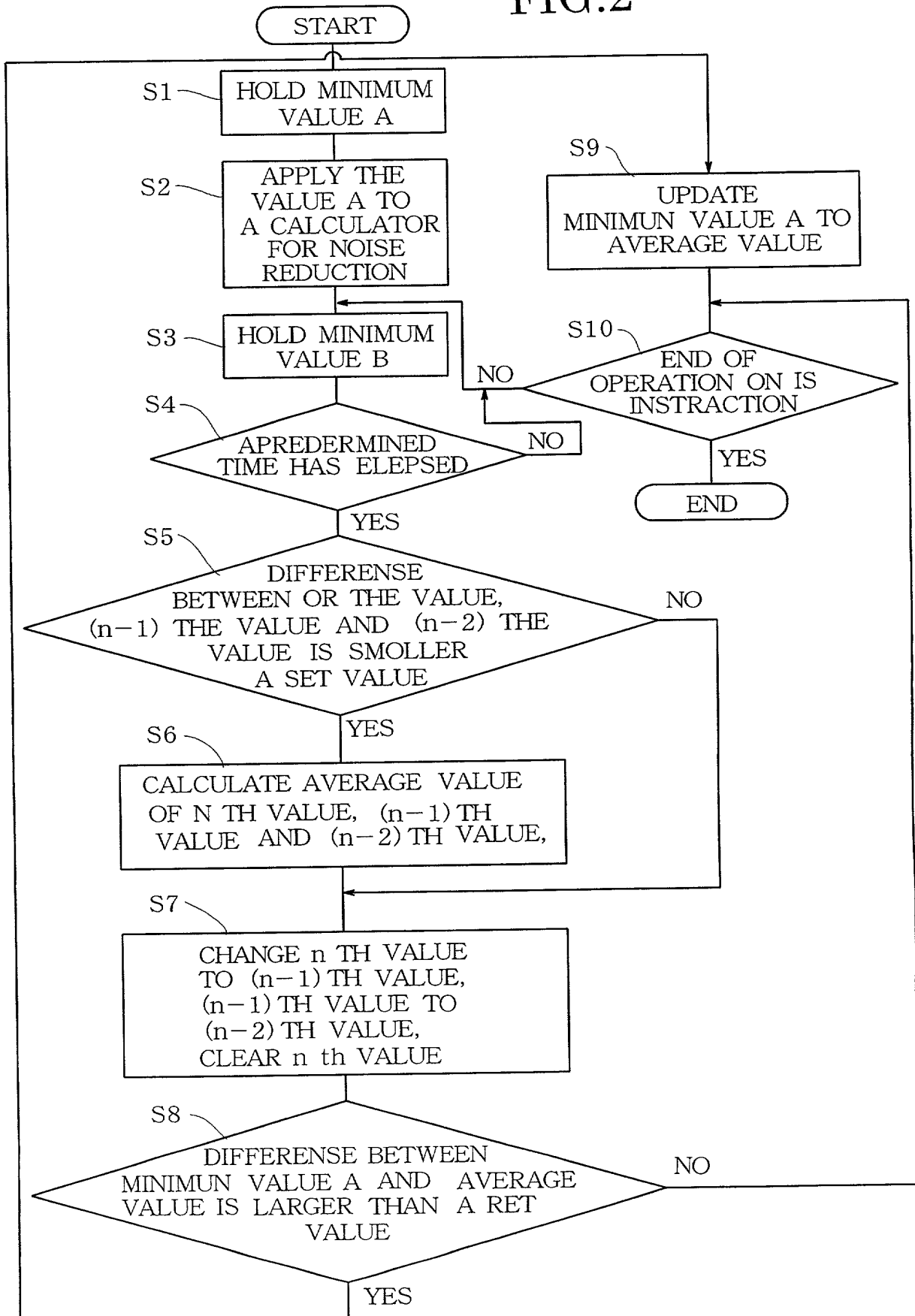


FIG. 3 a

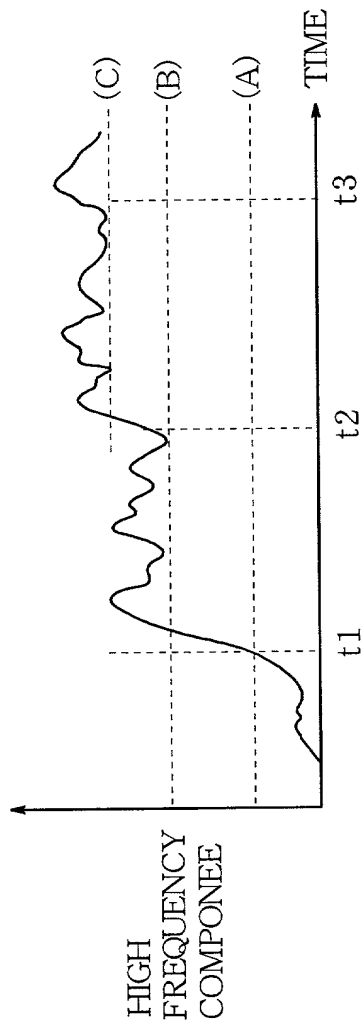


FIG. 3 b

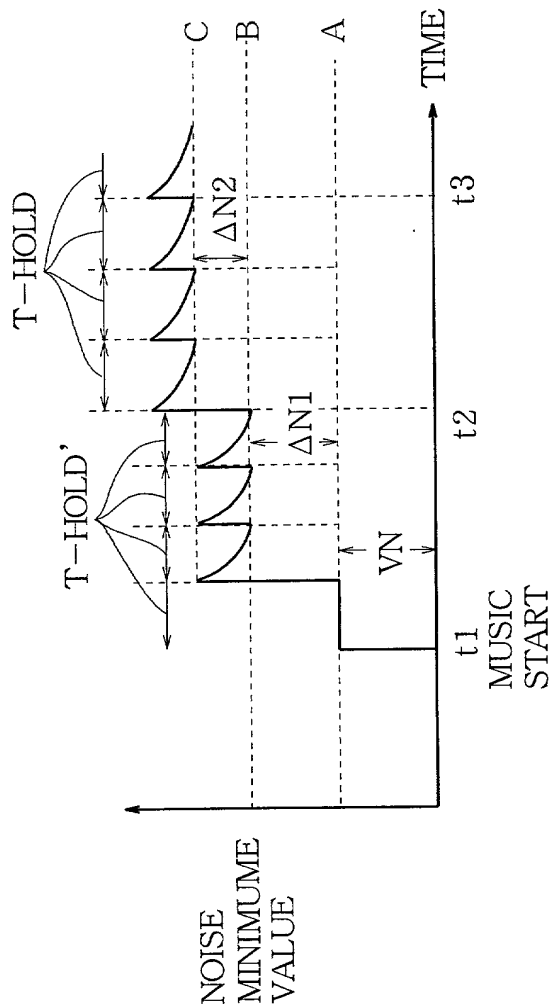
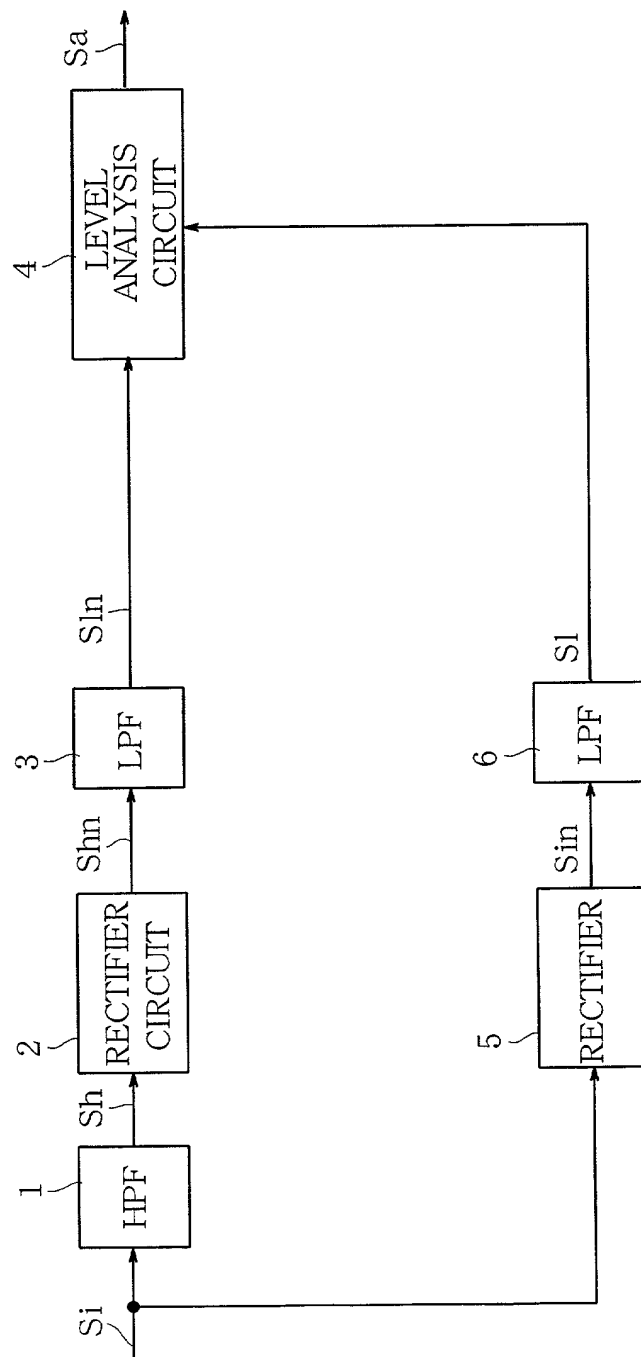


FIG.4



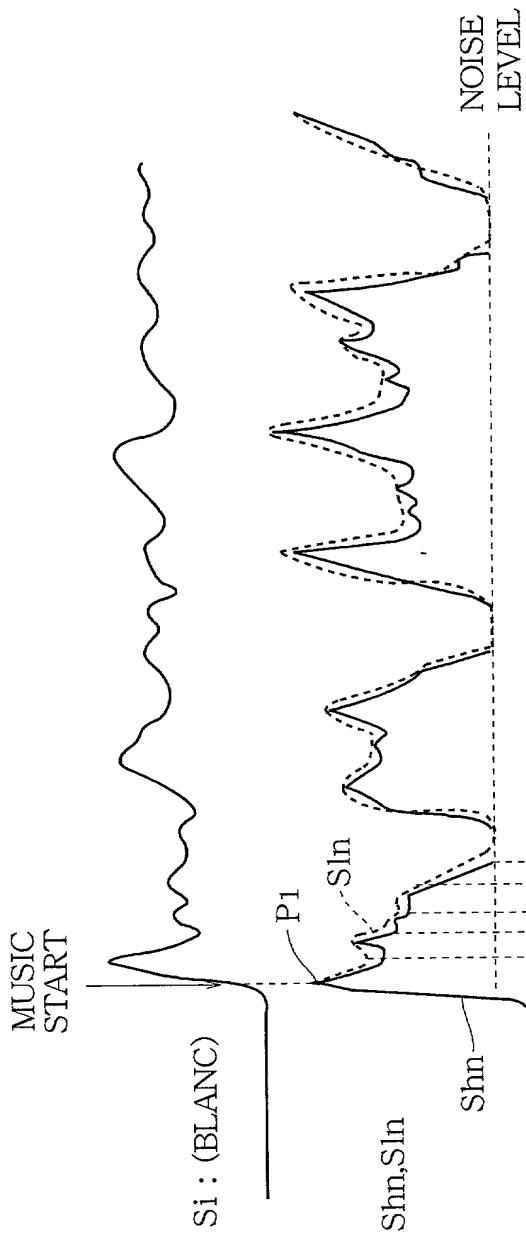


FIG. 5 a

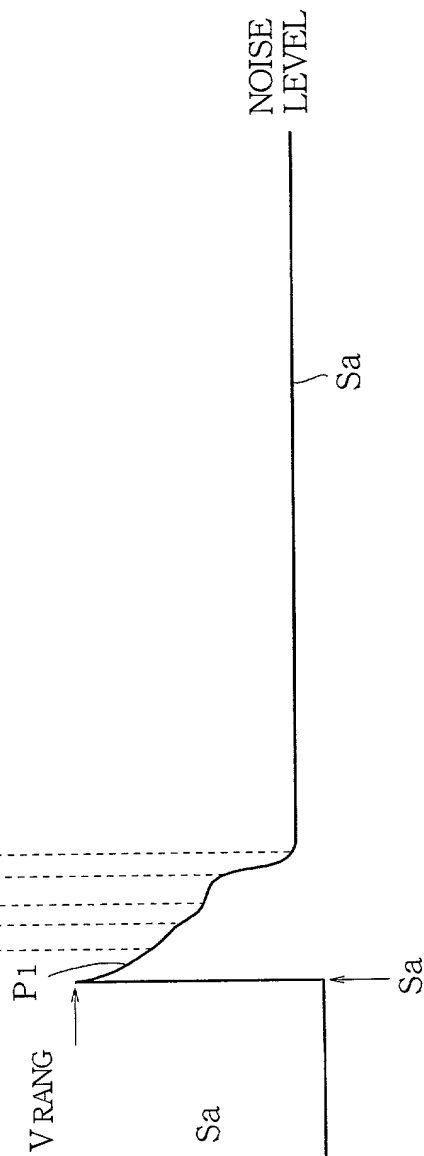


FIG. 5 b

FIG. 5 c

Declaration For U.S. Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
(Insert Title) "Noise Level Updating System"

the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International Application having a filing date before that of the application(s) for which priority is claimed:

(List prior foreign applications. See note A on back of this page)	<u>10-072904</u>	<u>Japan</u>	<u>20/03/1998</u>	Priority Claimed
	(Number)	(Country)	(Day/Month/Year Filed)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
	<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes <input type="checkbox"/> No
	(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No
	<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> Yes <input type="checkbox"/> No
	(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

<u> </u>	<u> </u>
(Application Number)	(Filing Date)
<u> </u>	<u> </u>
(Application Number)	(Filing Date)

(See Note B on back of this page)

☐ See attached list for additional prior foreign or provisional applications.

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365(c) of any PCT International application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) (U.S. or PCT) in the manner provided by the first paragraph of 35, U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(List prior U.S. Applications or PCT International applications designating the U.S.)	<u> </u>	<u> </u>	<u> </u>
	(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
	<u> </u>	<u> </u>	<u> </u>
	(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

And I hereby appoint as principal attorneys David T. Nikaido, Reg. No. 22,663; Charles M. Marmelstein, Reg. No. 25,895; George E. Oram, Jr., Reg. No. 27,931; Robert B. Murray, Reg. No. 22,980; Martin S. Postman, Reg. No. 18,570; E. Marcie Emas, Reg. No. 32,131; Douglas H. Goldhush, Reg. No. 33,125; Kevin C. Brown, Reg. No. 32,402; Monica Chin Kitts, Reg. No. 36,105; and Richard J. Berman, Reg. No. 39,107.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(See Note C on back of this page)

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Citizenship Japan

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Inventor's signature _____

Residence _____

Citizenship _____

Post Office Address _____

Full name of third joint inventor, if any _____

Inventor's signature _____

Residence _____

Citizenship _____

Post Office Address _____

Full name of fourth joint inventor, if any _____

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Residence _____

Citizenship _____

Post Office Address _____

Full name of fifth joint inventor, if any _____

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Residence _____

Citizenship _____

Post Office Address _____

Full name of sixth joint inventor, if any _____

Inventor's signature _____

Residence _____

Citizenship _____

Post Office Address _____

Full name of seventh joint inventor, if any _____

Inventor's signature _____

Residence _____

Citizenship _____

Post Office Address _____

Full name of eighth joint inventor, if any _____

Inventor's signature _____

Residence _____

Citizenship _____

Post Office Address _____

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